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SPORONEMA CAMELLIAE n. sp.

Epiphyllous on large white brown-bordered spots or areas, 2–5 cm. in diameter; perithecia thickly scattered, buried, elevating the epidermis, orbicular or somewhat elongate, usually rimosely dehiscent, occasionally stellate-laciniate, becoming discoid, of firm cellular texture, about 200 μ; spores cylindric, ends obtusely rounded, sometimes curved, usually bi-guttate, 12–18x4–5 μ; basidia short and thick, about equalling the spore, usually simple.

On living leaves of *Camellia Japonica*, Auburn, Ala., March and April, 1896. J. S. Burton.

The spots resemble very closely those caused by *Pestalozzia Guepini* Desm.

SPORONEMA ILICIS n. sp.

Epiphyllous on large deadened and whitened areas, usually involving the apical portion of the leaf; perithecia often somewhat concentrically arranged, or thickly scattered, large, brown, membranous, buried in the epidermis and coming off with it, usually somewhat elongate, elevating the epidermis and at length cracking it longitudinally or stellately; spores continuous, elliptic, hyaline, on short simple hyaline basidia about 12–15 x 4–6 μ.

On languishing leaves of *Ilex opaca*, Auburn, Ala., December, 1895; January, February and March, 1896. Underwood & Earle.

From a fourth to a half of the leaf is usually dead and conspicuously whitened. The living portion is usually bounded by a broad intermediate dark purplish border. The gross appearance is much like *Phyllosticta opaca* E. & E., N. A. F. 3443, but the spores are entirely different.

ALABAMA POLYTECHNIC INSTITUTE, AUBURN, ALA.

Reinke's Discussions of Lichenology.

BY ALBERT SCHNEIDER.

III.

PRELIMINARY CONSIDERATIONS OF A PHYLOGENETIC MORPHOLOGY OF LICHENS.*

Acharius,† the father of lichenology, classified lichens as a distinct order of plants. This method was not followed by later botanists who included these plants sometimes with algae and sometimes with fungi. Nägeli* placed them with the algae under the family Lichenaceae, stating that they agree in vegetative habit with the Stilophoreae and Fucaceae. So-called modern botany persists in placing lichens with fungi, a procedure which the author has always considered unnatural and unscientific, because morphologically lichens resemble green assimilating plants (algae, etc.) and not fungi. Morphological conformation and habit is in all cases the expression of the organization of plants as they develop in obedience to the requirements of biological existence.

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* Reinke, J. Einige Voraussetzungen einer phylogenetischen Morphologie der Flechten. Pringsheim's Jahrbücher, 28: 39–69. 1895.

† Acharius, E. Lichenographia Universalis, Göttingen, 1810.

Sometimes plants that are widely separate as to their habits show a great similarity of form. Nothing would however be farther from the truth than to assume that these similarities of gross appearance were due to identical or similar causes. As an illustration is cited *Clavaria flava* and *Cladonia uncialis*. In both the anatomical conformations secure a maximum of surface-expansion. In the former plant this is for the special purpose of furthering reproduction, in the latter for the special purpose of furthering assimilation. A few similar illustrations are given, which emphasize the necessity of giving correct physiological interpretations to the structural conformations.

The author now enters upon a highly theoretical discussion of classification. A system may be either practical and artificial or theoretical and natural. Furthermore, the modern natural system is supposed to be built upon the basis of phylogenesis. The author has purposely refrained from designating the natural system as scientific, since the artificial system is likewise scientific.

There is no sound basis upon which to build a phylogenetic system. Paleontology fails us in the consideration of the most important questions; this is particularly true in the phylogeny of the thallophytes. Here we are almost entirely dependent upon evidence deduced from a study of the comparative morphology of existing plants. But what scientific right have we to formulate conclusions from such comparisons? What evidence have we of the genetic relationship of plant-types? The emphatic statement that ontogeny represents phylogenetic development is nothing more nor less than a mere thesis which is worshipped by those whom scruples and doubt do not enthrall, and who, in their sanguinism, accept that as truth which in their estimation is desirable. The phylogenetic method of procedure has some scientific value. as is evidenced from the paleontologic data of general evolution. It is necessary in all cases to add to these phylogenetic constructions certain hypothetical assumptions so as to form a rationally appearing chain of evidence. To exclude hypothetical assumptions from the domains of science is impossible; they are necessary in botany as well as in physics and chemistry. It is the object of science to point out what constitutes positive facts and what is only relatively true or hypothetical. If we ignore this distinction we become unscientific. As an illustration, may be mentioned the premature fruit of hyper-Darwinism, which has such a deleterious influence in the realms of natural science.

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* Nägeli, K. Die neuen Algensysteme, und Versuch zur Begründung eines eignen Systems der Algen und Florideen, Zürich, 1847.

The parts of a plant stand to each other in the relation of a morphological equilibrium. This equilibrium is more or less labile, but it may acquire a high degree of stability. In a given individual the greatest morphological lability exists in the embryo. It tends toward continual change. Among the higher plants (ex., a tree), there are as many points of labile equilibrium as there are meristematic areas. A mature leaf has reached the state of stable equilibrium; it changes neither in size or form. Neoformations may however be induced by special stimuli, producing a state of temporary lability.

All species are in a state of morphological lability as long as they are variable. Struggle for existence and other causes finally produced stability of form.

At this point the author's arguments become peculiarly weak and antiquated. He assumes that the majority of plants and animals now living have reached a state of morphological stability. Many stable forms have gone out of existence because they could not adapt themselves to the changes in environment. As evidence for the existence of such stability the author states that our most common plants of cultivation have not undergone any appreciable change within thousands of years. Man is cited to illustrate stability in the animal kingdom. Homer is compared with moderns to prove that the psychological peculiarities have not undergone any changes within 4,000 years. He concludes that if man were a labile organism he would have undergone some appreciable change within that period. Temporary lability may occur, but there is a continual tendency toward the stable forms, or an optimum of adaptability. This peculiarly dogmatic argument has about it a certain cadaveric odor. It is in sharp contrast to the author's usually scientifically rational arguments.

The discussion of the lichen-thallus is next taken up. Sachs* maintains that the flatness of the lichen-thallus (foliose) is due to the direct influence of sunlight (photomorphosis). Reinke points out that this can not be the cause, since there are numerous lichens with fruticose thalli. Wherever or in what form the lichen-thallus occurs, it indicates a special morphological adaptation to favor the function of assimilation. If light and chlorophyll were the only factors concerned, then all assimilating organs would have the same structure, since constant factors must produce constant results.

Since lichens undoubtedly have a polyphyletic origin we have a striking illustration of the fact that identical morphological adaptations may be produced in phylogenetically distinct series. It demonstrates that a plant which is most suitably adapted to its environment constitutes a stable form, toward which the less perfect forms of the series tend. The author concludes that sexuality is the cause of variation; therefore, lichens which are propagated by soredia alone must have reached the highest degree of stability. The phylogenetic development in lichens must have been the result of reproduction from spores and gonidia. If a lichen in the course of its phylogenetic development becomes associated with a new alga it is changed from a stable form to a labile form. It may also be possible that one and the same fungus may unite with different algae (forms of *Cora*, *Sticta*, *Stictina*, and *Solarina*). This subject, however, requires further study. Change of algae has already been observed by Forssell.† According to Bonnier,‡ lichens may also utilize the protonemas of various mosses. There is no doubt that many of the lower lichens will develop to some extent (in artificial media) without the algae,* but no lichen-fungus will develop to maturity in nature. From this we may conclude that all fungi which have entered into the formation of lichens no longer exist.

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* Sachs, J. Physiologische Notizen, VIII. Mechanomorphose und Phylogenie. Flora, 78: 215–243. 1894.

† Forssell, K. B. J. Lichenologische Untersuchungen. Flora, 64: 1–8, 33–46. 1884.

‡ Bonnier, G. Germination des Lichens sur les protonémas des Mousses. Rev. Gen. de Bot. 1: 165–169. 1889.

Phylogenetic morphology is intimately related to classification. It supplies science with the necessary building material for the natural system of the future. Conversely systematists in their various and varied attempts at classification have unconsciously added to our knowledge of phylogenetic morphology.

In a natural system the oldest morphological characters serve to limit the main divisions; the next oldest limit the families. The more recently acquired characters serve to define the genera and species. It is often difficult to determine what are in reality the old and new characters. In this difficulty lichens prove very interesting because it is to a certain degree possible to determine the relative ages of the phylogenetically acquired characters. The more recent characters occur in the thallus; the oldest in the apothecium and related structures, since these are as old as the lichen plus the age of the fungal ancestor. Accordingly the main divisions of the lichen-system should be based upon the characters of the apothecia, and not upon the thallus-characters. This, however, does not imply that the apothecia have undergone no variation; the variation is even considerable, as becomes evident upon comparing the lecanorine type with the lecideine. The same may be said of the spores. In general, however, the variations in the thallus are much more considerable and represent the direct characters of adaptation.

The future system of lichens will also consider the relation of these plants to their probable fungal ancestors. In the limitation of the genera it will be necessary to determine whether or not a given character was transmitted from the fungal ancestor or whether it was newly acquired.

The following is a brief summary of this paper:

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* Möller. Ueber die Kultur flechtenbildender Ascomyceten ohne Algen. Münster. 1887.

1. Morphological similarities may be induced by wholly distinct causes and may serve wholly different ends.

2. The majority of species (both vegetable and animal) are stable. Temporary lability may be induced artificially or otherwise. All subsequent changes again tend toward the stable form.

3. The form of the lichen-thallus indicates a special morphological adaptation to favor the function of assimilation.

4. The phylogenetic morphological characters of lichens are of great significance in the formation of a natural system as well as in the consideration of phylogenesis in general.

5. The more recently acquired characters of lichens are to be found in the thallus; the oldest in the apothecial structures.

6. The entire lichen-structure has undergone considerable change since its phylogenetic history.

New or Noteworthy American Grasses.—V.

By Geo. V. Nash.

Erianthus Tracyi n. sp.

Culms stout, erect, 2–4 m. high, smooth and glabrous, the nodes upwardly barbed with deciduous silky hairs, about 1 cm. long; sheaths closely embracing the culm, shorter than the internodes, smooth, glabrous, except at the apex, where they are pubescent with deciduous, long, silky, appressed hairs; ligule rounded, about 5 mm. long; leaves 5 dm. long or more, 1.5–3 cm. broad, narrowed toward the base, long-acuminate toward the apex, strongly scabrous on both surfaces, pilose on the upper side toward the base; panicle oblong, 3–5 dm. long, 8–12 cm. wide, cream-white, dense, the main axis and branches pubescent with long appressed silky hairs, the branches usually in 2's, much divided, ascending or nearly erect, 15 cm. long or less; spikelets lanceolate, 5–6 mm. long, about one-half again as long as the internodes, yellowish brown, usually marked with red, less than one-half the length of the involucral hairs; first and second scales firm-membranous, the former a little the longer, both pubescent with silky hairs, twice the length of the scales, the first acuminate, faintly 7-nerved at the base, 2-toothed and prominently 2-nerved at the apex, the two nerves scabrous, the second scale acute, the nerves hardly discernible; third and fourth scales hyaline, shorter than the first and second ones, ciliate on the margins, the third acute,